IN THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1 – 17. Canceled.

18(Currently Amended). A method of binary coded data communication comprising:

providing a transmitter having a turbo trellis coded modulator (TTCM) encoder and constellation shaping elements;

dividing a desired symbol sequence into a first part having K-bits, a second part having N*k-bits, and a third part having the remaining bits;

processing the first part of the desired symbol sequence via a shell mapper to generate N shells;

processing the second part of the desired symbol sequence via the TTCM encoder to generate N cosets; ~~and~~

mapping the third part of the desired symbol sequence, the N shells, and the N cosets to generate N transmit symbols, wherein N, K, and k are integers;

providing a receiver having a receiver turbo decoder and receiver constellation shaping elements; and

processing the N symbols via the receiver turbo decoder and the receiver constellation shaping elements to recover the desired symbol sequence wherein the step of processing the N symbols comprises the steps of:

decoding the N symbols via the turbo receiver decoder to generate N hard symbols,

de-mapping the N hard symbols into the first part of the desired symbol sequence via a shell de-mapper,

mapping the N hard symbols into the remaining part of the desired symbol sequence via a symbols to bits mapper, and

combining the first part of the desired symbol sequence recovered by the shell de-mapper with remaining part of the desired symbol sequence recovered by the symbols to bits mapper to recover the desired symbol sequence at the receiver.

19. Canceled.

20(Currently Amended). The method according to claim ~~19~~ 18 wherein the step of processing the N symbols via the receiver turbo decoder and the receiver constellation shaping elements to recover the desired symbol sequence comprises processing the N symbols via the turbo decoder using a non equi-probable symbol distribution.

21. Canceled.

22 (Previously Presented). The method of binary coded data communication according to claim 18 further comprising the step of processing the N symbols via a Laroia precoder to generate a precoded symbol sequence.

23. Canceled.

24 (Currently Amended). The method according to claim ~~23~~ 18 wherein the step of processing the precoded symbol sequence via the receiver turbo decoder and the receiver constellation shaping elements to recover the desired symbol sequence comprises processing the precoded symbol sequence via the turbo decoder using a non equi-probable symbol distribution.

25 (Currently Amended). The method of binary coded data communication according to claim ~~23~~ 18 wherein the step of processing the coded symbol sequence comprises the steps of:

decoding the precoded symbol sequence via the turbo decoder to generate N hard symbols;

processing N hard symbols to reconstruct symbols by the Laroia precoder input;

de-mapping the reconstructed symbols into the first part of the desired symbol sequence via a shell de-mapper;

mapping the reconstructed symbols into remaining part of the desired symbol sequence via a symbols to bits mapper; and

combining the first part of the desired symbol sequence recovered by the shell de-mapper with the remaining part of the desired symbol sequence recovered by the symbols to bits mapper to recover the desired symbol sequence at the receiver.

26 – 49. Canceled.

50(New). A method of processing incoming signals in a receiver comprising:

receiving a sequence of N symbols;

processing the N symbols via a receiver turbo decoder and a receiver constellation shaping elements to recover the desired symbol sequence wherein the step of processing the N symbols comprises the steps of:

decoding the N symbols via a turbo receiver decoder to generate N hard symbols;

de-mapping the N hard symbols into a first part of a desired symbol sequence via a shell de-mapper;

mapping the N hard symbols into the remaining part of the desired symbol sequence via a symbols to bits mapper; and

combining the first part of the desired symbol sequence recovered by the shell de-mapper with remaining part of the desired symbol sequence recovered by the symbols to bits mapper to recover the desired symbol sequence.

51(New). A method according to claim 50, wherein the step of processing the N symbols via the receiver turbo decoder and the receiver constellation shaping elements to recover the desired symbol sequence comprises processing the N symbols via the turbo decoder using a non equi-probable symbol distribution.

52(New). A method according to claim 50, wherein the sequence of N symbols is received from a transmitter having a transmitter turbo trellis coded modulator (TTCM) encoder and transmitter constellation shaping elements and the sequence of N symbols is generated by:

dividing a desired symbol sequence into a first part having K-bits, a second part having N*k-bits, and a third part having the remaining bits;

processing the first part of the desired symbol sequence via a shell mapper to generate N shells;

processing the second part of the desired symbol sequence via the transmitter TTCM encoder to generate N cosets; and

mapping the third part of the desired symbol sequence, the N shells, and the N cosets to generate the sequence of N symbols, wherein N, K, and k are integers.

53(New). A method according to claim 52, further comprising:

processing the N symbols at the transmitter via a Laroia precoder to generate a precoded sequence of N symbols.

54(New). A method according to claim 53, wherein the sequence of N symbols received by the receiver is the precoded sequence of N symbols, the turbo decoder decodes the precoded sequence of N symbols to generate the N hard symbols, and the N hard symbols are processed to reconstruct symbols by the Laroia precoder input.

55(New). A binary coded data communication system comprising:

a transmitter having a turbo trellis coded modulator (TTCM) encoder and constellation shaping elements; and

a receiver having a turbo receiver decoder and a receiver constellation shaping elements, wherein the receiver is configured to:

receive a sequence of N symbols from the transmitter;

process the N symbols via the turbo receiver decoder and the receiver constellation shaping elements to recover desired symbol sequence by:

decoding the N symbols via the turbo receiver decoder to generate N hard symbols;

de-mapping the N hard symbols into a first part of a desired symbol sequence via a shell de-mapper;

mapping the N hard symbols into the remaining part of the desired symbol sequence via a symbols to bits mapper; and

combining the first part of the desired symbol sequence recovered by the shell de-mapper with remaining part of the desired symbol sequence recovered by the symbols to bits mapper to recover the desired symbol sequence.

56(New). A system according to claim 55 wherein the TTCM encoder is configured to generate a rate k_c/n_c TTCM code in response to a k_c -tuple part of a desired symbol sequence, and the constellation shaping elements of the transmitter comprise:

a coset representative generator configured to generate a rate k_s/n_s convolutional shaping code, where $k_s = n_s - r_s$, in response to a r_s -tuple part of the desired symbol sequence;

a shaping code decoder configured to generate a desired bit sequence in response to an uncoded binary n_u -tuple part of the desired symbol sequence, the rate k_c/n_c TTCM code, and the rate k_s/n_s convolutional shaping code.

57(New). A system according to claim 56 wherein the turbo receiver decoder employs a non equi-probable symbol distribution.

58(New). A system according to claim 26 wherein the constellation shaping elements comprise trellis shaping elements.

59(New). A system according to claim 58, the constellation shaping elements of the transmitter further comprise:

a combinational element configured to generate a transmit symbol sequence in response to the desired bit sequence and the rate k_s/n_s convolutional shaping code; and

a mapper configured to generate a plurality of signal points in response to the transmit symbol sequence, the uncoded binary n_u -tuple part of the desired symbol

sequence, and the generated rate k_c/n_c TTCM code, wherein k_c, n_c, n_u, r_s, k_s, and n_s are integers.

60(New). A system according to claim 59 wherein the turbo decoder is configured to receive the plurality of signal points via a transmission medium and generate estimated signal points therefrom, and further wherein the receiver constellation shaping elements comprise an inverse mapper configured to receive and process the estimated signal points to generate an estimated binary k_c-tuple part of the desired bit sequence according to the rate k_c/n_c TTCM code, an estimated binary n_u-tuple part of the desired symbol sequence, and an estimated binary r_s-tuple part of the desired bit sequence according to the rate k_s/n_s convolutional shaping code.

61(New). A system according to claim 60 wherein the receiver constellation shaping elements further comprise a bit recovery element configured to process the estimated binary k_c-tuple part of the desired bit sequence according to the rate k_c/n_c TTCM code such that k bits can be recovered based on n bits to generate an estimated binary k_c-tuple part of the desired symbol sequence.

62(New). A system according to claim 61 wherein the receiver constellation shaping elements further comprise a transformation element configured to process the estimated binary r_s-tuple part of the desired bit sequence according to the rate k_s/n_s convolutional shaping code and therefrom generate an estimated syndrome r_s-tuple part of the desired symbol sequence.

63(New). A system according to claim 59 wherein the transmitter further comprises a trellis precoder operational to generate a coded symbol sequence in response to the plurality of signal points.

64(New). A system according to claim 63 wherein the receiver further comprises a folding element operational to generate a folded constellation in response to the coded symbol sequence.

65(New). A system according to claim 64 wherein the turbo decoder is configured to generate estimated signal points in response to the folded constellation, and the receiver constellation shaping elements further comprise an inverse mapper configured to generate an estimated binary k_c-tuple part of the desired bit sequence according to the rate k_c/n_c TTCM code, an estimated uncoded binary n_u-tuple part of the desired symbol sequence, and an estimated binary r_s-tuple part of the desired bit sequence according to the rate k_s/n_s convolutional shaping code in response to the estimated signal points.

66(New). A system according to claim 65 wherein the receiver constellation shaping elements further comprise a bit recovery element configured to process the estimated binary k_c-tuple part of the desired bit sequence according to the rate k_c/n_c TTCM code such that k bits can be recovered based on n bits to generate an estimated binary k_c-tuple part of the desired symbol sequence.

67(New). A system according to claim 66 wherein the receiver constellation shaping elements further comprise a transformation element configured to process the estimated binary r_s-tuple part of the desired bit sequence according to the rate k_s/n_s convolutional shaping code and therefrom generate an estimated syndrome r_s-tuple part of the desired symbol sequence.

68(New). A system according to claim 63 wherein the trellis precoder comprises a Tomlinson-Harashima precoder.

69(New). A system according to claim 55 wherein the constellation shaping elements comprise shell mapping elements.

70(New). A system according to claim 69 wherein TTCM encoder of the transmitter is configured to process the second part of the partitioned symbol sequence to generate N cosets.

71(New). A system according to claim 70 wherein the constellation shaping elements of the transmitter comprise:

a shell mapper configured to process the first part of the partitioned symbol sequence to generate N shells; and

a mapper configured to process the third part of the partitioned symbol sequence, the N shells, and the N cosets to generate N transmit symbols.

72(New). A system according to claim 71 wherein the receiver turbo decoder is configured to process the N symbols to generate N hard symbols and wherein the receiver constellation shaping elements comprise:

a symbols-to-bits mapper configured to map the N hard symbols into the third part of the partitioned symbol sequence;

a shell de-mapper configured to de-map the N hard symbols into the first part of the partitioned symbol sequence; and

a combinational element configured to combine the first part of the partitioned symbol sequence recovered by the shell de-mapper with the third part of the partitioned symbol sequence recovered by the symbols-to-bits mapper to recover the partitioned symbol sequence at the receiver.

73(New). A system according to claim 71 wherein the transmitter further comprises a Laroia precoder operational to generate a precoded symbol sequence in response to the N signals.

74(New). A system according to claim 73 wherein the receiver turbo decoder is configured to process the coded symbol sequence to generate N hard symbols and wherein the receiver constellation shaping elements comprise:

a symbol processor configured to process the N hard symbols to reconstruct symbols appearing at the Laroia precoder input;

a shell de-mapper configured to de-map the reconstructed symbols into the first part of the desired symbol sequence;

a symbols-to-bits mapper configured to map the reconstructed symbols into the remaining part of the desired symbol sequence; and

a combinational element configured to combine the first part of the desired symbol sequence recovered by the shell de-mapper with the remaining part of the desired symbol sequence recovered by the symbols-to-bits mapper to recover the partitioned symbol sequence at the receiver.